Computing News

News from the Computing Division

Fermi National Accelerator Laboratory

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This issue of the Computing Division Newsletter is dedicated to a discussion of how the Linux operating system will be supported at Fermilab on computers based on the Intel Pentium family of microprocessors. [In this document, the term Intel PC refers to Intel Pentium processors.] We have tried to position Fermilab to take advantage of powerful, cost effective computing solutions at all scales — from desktop systems to very large multiprocessor compute servers. We have emphasized RISC-based computers running Unix for data analysis and scientific computing and Intel systems running Windows NT for general administrative, technical, and (some) scientific computing. Over the last few years, Intel Pentium chips have increased in power and dropped in cost, and they now also have become cost effective solutions for data analysis. For a little over a year, we have been working on porting and testing the standard HEP programs and tools to Linux on these systems. We began with Linux rather than Windows NT because it is very close to our standard Unix environment. We now feel confident that we can support Linux for use in processor farms for event reconstruction and simulation, for Level III triggering, and for desktop scientific computing.

At present, we are not fully prepared to support Windows NT to carry out these tasks, but we do plan to begin a serious study of what is involved. A limited step in this direction is support for the Windows NT Microsoft Visual C++ combination in the Fermilab Physics Class Library. We are especially interested in understanding what role NT could play in the final analysis phases (e.g., PAW) and whether commercial analysis packages could be of value to us. We will report to you on our progress periodically over the next year or so.

Linux Support Policy

1. ***Linux on Intel PCs will be supported at Fermilab.***
2. ***Linux on any other hardware platform will not be supported.***
3. ***Redhat will be used as the basis for Fermilab's Linux.***
4. ***Support mechanisms will be similar to current support arrangements for Unix systems. Central systems will be supported by the appropriate groups in the Computing Division. Desktop support will either be handled locally or by a combination of local support and the Computing Division. Data acquisition support will be handled under the normal development and support arrangements through the MOU process.***
5. ***Most but not all supported applications will be made available on Linux. Supported products will be made available by their regular support group through the standard KITS distribution means and/or via the Linux install server.***
6. ***Linux OS certification and environment support will be handled in a similar way to any other Unix OS. Details will be found in the CD documents DR0004, DR0009 and DR0010.***

Very powerful PCs which run a variant of the Unix operating system (Linux) are a cost-effective way of providing large amounts of CPU time in computing farms and inexpensive yet powerful desk-top systems for physicists. Fermilab has been exploring this and other options for both farms and desktop systems.

A year-long evaluation by the Computing Division was carried out as part of the decision-making process. After consideration of the issues involved and the requests coming from the Fermilab community, we have decided on limited support of Linux. We will not support Linux in all of its flavors and on all the hardware platforms on which it runs. We feel that limiting the hardware and flavors of Linux will allow better support, and that without this limitation we would not likely be able to support it at all. Please note that the limitation applies to products and applications as well. It will not be possible to support all possible products nor all types of applications on Linux.

The results and information about the Fermilab evaluation project is found at:
`http://www-ols.fnal.gov/ols/doc/linux/linux.html`

Providing support for a new flavor of Unix is not free, though it is certainly not as difficult as supporting a new type of operating system. We feel that we can support Linux, as long as the Linux that we support is limited to certain well-specified hardware and operating system flavors. This will be spelled out in the sections that follow.

There are significantly different issues involved in desktop and farm computing. Our investigations of Linux farms and the work done at other HEP labs has shown that the ability of PCs to provide massive computing power at low cost offers significant advantages. We feel confident that Linux farms can be built and run successfully. The desktop computing issue is much more difficult. The desktop is used for many things besides intensive computing. Desktops are used for word processing, email, physics analysis, presentation preparation, web browsing, etc. These services can be provided in a variety of ways, including Linux running on a PC. We do not know yet how much effort will be involved in providing Linux on the desktop. We do expect that many physicists will purchase PCs to run Linux. Linux/NT (dual boot) or NT alone. Each of these possibilities will make sense to some people. None of these possibilities will be excluded by this policy.

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`http://www.fnal.gov/docs/Recommendations/dr0011.html`
`http://cddocs.fnal.gov/cfdocs/productsDB/docs.html`
`http://www.fnal.gov/cd/unix/linux/`

Hardware Support

The selection of hardware for Linux workstations includes more choices from a wider menu of options than for a traditional Unix workstation. This is a direct result of the market volume which has been so effective at reducing costs for the PC; it is also one of the “hidden” costs of PC-based solutions. It is our belief that PCs do still represent a cost savings to the laboratory, but you need to be careful to consider the support issues in making purchasing decisions.

The strategy of the Computing Division is to take advantage of the significant cost savings made possible by using “mainstream” hardware suppliers. This implies that you should not necessarily take advantage of the absolute best price/performance solution at any given time (which is rarely as important as issues of support and usability). The Computing Division definition of a Unix flavor, including the new flavor Linux, is based on the concept of binary compatibility, which in turn depends on the underlying hardware.

As an immediate result of these considerations, we are restricting our support of Linux to the Intel-based processor machines. We are explicitly **not** supporting Linux on (for example) Alpha or SPARC-based PCs. Certain vendors of clone CPU chips (Cyrix, AMD, etc.,) are reported to have good success running Linux. While we have reason to expect binary compatibility on these latter machines, CD-developed code will not be explicitly tested against these combinations. People choosing to use these processors should expect a lower level of support.

Within the Intel-based market, Linux installations have proven to be quite sensitive to the selection of video and network interface cards. These cards tend to have a very rapid development cycle, making them prone to lags in availability of drivers. Some video and/or network cards are not compatible with Linux at all. It is our **strong** recommendation that you select market leader devices, particularly in these two areas, and avoid the off-brand selections. Most name-brand devices are eventually well-supported, though the “bleeding edge” selection may take longer and entail some work.

Each release of Linux includes a list of hardware which is supported by that distribution. You should select your systems from this list. The current list is available at

http://www.fnal.gov/cd/unix/linux/

You may also look at the newsgroup comp.os.Linux.hardware for the latest information. If you are planning to purchase Linux workstations, read the information at the above URL and contact your local system administrator.

Notebooks are a growing population of PCs within the laboratory, and they too now have the capacity to run Linux. Given the focus of Linux support on computational farms and scientific desktops, we will not be supporting notebooks at this time. We anticipate re-evaluating this decision after the initial phase of Linux deployment at the laboratory.

Dane Skow, dane@fnal.gov
Head, Operating System Support Department

Operating System Support (FAQ about Linux Support)

What is the intended purpose of these Linux Desktops?

The main use that we see for Linux is as a "Unix" Scientific workstation. If an "office system" is needed, then NT should be the platform of choice.

Will Linux be a supported OS?

Linux will go through the normal Computing Division OS "certification" process.

What Linux Distribution will be supported?

There are many different distributions of Linux available. After researching each of them, the Computing Division has decided to support the Redhat distribution. Local modifications to Redhat have been made to incorporate bug fixes and to simplify installation and support.

Where can I get Documentation?

Documentation will be provided via the web. See http://www.fnal.gov/cd/unix/linux

How do I install Linux?

An install server will be provided for nfs/ftp installs. The install floppy can either be created locally after being downloaded from the install server or obtained from the Computing Division. See the following url for more information: http://www.fnal.gov/cd/unix/linux

How do I get install support?

If install support is required, a request to the Computing Division must be made. See http://www.fnal.gov/cd/unix/linux

What about on-going system administration support?

One needs to plan for the on-going administrative support of Linux. If you want to support the system yourself then you can make that decision. If not, then you need to request formal support from the Computing Division.

How will upgrades and patches be made available?

Patches and upgrades will be available on the install server.

Are there any special Hardware requirements needed to run Linux?

Yes. Please see the "Hardware support" section of this document for hardware information.

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Head, Field Systems Group

Software Support FUE meets Linux application software

Does it make sense to provide a FUE package?

FUE (Fermi Unix Environment) is the means by which the Computing Division provides application software to our customers. The FUE framework includes the following features:

- Multiple concurrent versions of the same software can co-exist on the same system; the individual user selects which version of the software should be invoked via the "setup" command.
- Applications can be declared such that they will call the correct specific version of other "dependent" products.

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- It is easy to determine which version(s) of each application have been installed on the system.
- Product distribution, installation, configuration, and initialization is consistent between all products on all supported Unix platforms.

Many of the applications which have been packaged as FUE-compliant products are available in "native" format as part of the Linux operating system (e.g., emacs, tk/tcl, gcc, etc.) This leads naturally to the question: is there value in providing FUE-compliant packages for Linux when many (if not most) of our applications (or their functional equivalents) already exist on that platform?

The answer is complicated, and differs from product to product. There are four main categories of product which we can consider:

1) Inherent to the system

Some products are absolutely inherent to the Linux operating system, and should not be modified or altered by being bent into the FUE framework. This includes the gcc compiler (and related tools). On the other supported platforms, we do not repackage the compilers and system libraries. If we consider gcc to be the "vendor-supplied" compiler for Linux, then it follows that we should not repackage gcc.

2) Loose version tracking

For many, many products, version tracking is not a terribly important consideration. These products remain relatively stable over long periods of time, or they do not interact strongly with other applications. These include applications such as gzip, gunzip, and ghostview. If the Linux-supplied version of these products function adequately, then there is little value in providing a FUE-compliant duplicate release. (And, one may argue, if the Linux-supplied version does **not** function properly, it is doubtful that we would be able to supply one that works any better).

3) Tight version tracking

There are, however, products upon which many physics (or other) applications are built, and where version tracking is of considerable importance. These include scripting languages such as tcl and perl, where it is important to control precisely which version of the language you are using. For this class of product, FUE-compliant packaging provides a familiar and consistent means of enforcing version control between related packages.

4) Not supplied with Linux

The final category of products are those which are not supplied with the Linux operating system, such as the locally-developed ups (Unix product support package), fmb (Fermi Modular Backup), and systools (a set of useful tools) packages. For these products, the FUE-compliant packaging makes good sense.

Based upon the guidelines outlined above, the Computing Division will provide FUE-compliant products for the Linux flavor of Unix when it makes sense to do so. We will not supply FUE-compliant packages when a Linux version is already included with the operating system, and there is little or no advantage in installing a FUE-compliant duplicate release.

Interaction with UPS for Run II

The FUE environment, including its most fundamental components ups and upd, is undergoing a major rewrite in preparation for Run II computing. The format of the ups database, the methods for describing product dependencies, and the details of product initialization (setup) are all being revised for ease of use and installation, speed enhancements, and product quality improvement. (Note, the user interface to ups, namely the `setup` command, will remain essentially unchanged.)

We anticipate that the UPS II format will be deployed in early 1998. While the new UPS will be able to manipulate products packaged in the old format, all products will need to be re-released before they can take advantage of the new features of UPS II.

One of the biggest changes in UPS II will be the ability to for UPS to be aware of "native" packages, instead of requiring that you re-install the FUE-compatible version. This will be an especially important feature in the Linux environment.

Therefore, we will not attempt to provide Linux packages until we have successfully deployed UPS II. All(*) FUE-compliant packages that we develop for Linux will be provided in the new format.

Some FUE-compliant packages have already been ported, though not necessarily certified, for Linux. Many of these are available from the Fermi products link on the Linux web page at:

`http://www.fnal.gov/cd/unix/linux/`

including: cern v97a, cvs v1_8_1, fmb, fmss v1_2e, fulib v4_2, funkern v5_1b, futil v5_2, nplot v4_0, octave v2_0_5, slatec v0_5b, systools v5_0, tcl v7_4df, tclx v7_4adf, tk v4_0df, upd v2_8e (certified) ups v3_9 (certified).

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These will remain available in the interim. As they are certified, the packages will become available through the standard KITS distribution system. (People with questions, concerns, or comments about the rewrite of ups are encouraged to contact `ups@fnal.gov`.)

Priorities for providing FUE-compliant packaging for Linux

Just as with any new Unix operating system, it will take some time to develop and deploy the application software for Linux. Our priorities will be:

1. core FUE applications required before other FUE applications will function (ups, upd, etc.)
2. supported physics applications required in a PC farm environment (cps, ftt, rbio, ocs, etc.)
3. supported applications which are not supplied with the Linux environment (and for which there are no functional equivalents within the Linux environment)
4. supported applications which are supplied with the Linux environment, but which would benefit from the tight version control between related products inherent in FUE (e.g., tk, tcl, perl)
5. other supported applications

Packages will be announced as they become available, and will be distributed from the KITS repository via upd.

What will not be available for Linux

Certain software products will not be made available for the Linux operating system. At the present time, these include:

1. EDT+: this legacy VMS-style editor is not available for Linux; and, as stated in August 1997, support for this editor has been frozen to existing releases and platforms; see `http://www.fnal.gov/docs/products/edt/`
2. tpu and fermitpu: this legacy VMS-style editor will also not be made available for Linux

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Head, Applications Group

Physics Analysis Software on Linux

The Physics Application Tools Department (PAT) will support Linux software for High Energy Physics Analysis. Note that some of our existing Unix software packages (including Nedit and Histoscope) have already been ported and are available from the Fermilab Linux web page. Other ports will occur in due time. For instance, the Physics Class C++ libraries that we are currently writing for Run II will be ported to Linux using the KAI compiler. One exception is the simulation package MCFAST, which uses VAX-FORTRAN data structures that are not supported by g77 on Linux. We are currently rewriting this package in C or C++. Once the conversion is done, we will consider a port to Linux. Other older software packages (CERN v9xx, PAW, GEANT3,...) will be provided on an “as needed” basis.

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Data Acquisition Packages

Several data acquisition packages have been developed for use under Linux: A CAMAC library for the Jorway 411 highway driver and Jorway 73A controller; a TRACE facility, which can be built into the Linux kernel to aid in debugging of real time applications; an ATM device driver; and FISION, a routine interface for access to VME.

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How to Order a PC to run Linux

Configuration of a Linux System

When ordering a system to run Linux it is important to understand that PC/Intel systems are made, for the most part, to run versions of the Microsoft Windows operating system: Windows, Windows for Workgroups, Windows 95 (soon 98) and/or Windows NT. The larger PC vendors typically test or "burn-in" these systems using the Microsoft operating systems. Manufacturers of PC equipment design and write software for their largest market, the Windows market. The software to support the many devices on a PC running Linux must follow and are typically not written or supported by the manufacturer. These Linux drivers and utilities are written by a number of computer enthusiasts and made available on Internet.

Intel/PC desktop systems are composed of hardware consisting of a motherboard, CPU, memory, and attached devices/controllers that drive the disks, monitors and network connections. When configuring any desktop system it is important to know the requirements of the system. How powerful will/should it be? How much memory will/should it have? How much data will it need to store (i.e., what size disk drive)? What type of monitor is required (17, 19, or 21 inch), and what refresh rate? How will it be connected to the network?

When using one of the major PC suppliers/integrators (e.g., Gateway, Micron, Dell, Compaq), it is important to understand that devices supplied from these vendors are configured and tested using Microsoft products (see above). The products they supply are only guaranteed (by them and the suppliers they use) to run using the Microsoft Operating Systems. That understood, when purchasing a system to run Linux, an additional step is required before submitting the purchase requisition. The desired system configuration must be checked to verify that the version of Linux is supported on that system, and that there are supported drivers (software) available for each of the controllers/devices installed on the system. This can be done by consulting web pages such as `http://www.fnal.gov/cd/unix/linux/` or by contacting the Computing Division. Even with these precautions, it is possible that computer suppliers will ship the system with substituted parts or newer revision levels of the requested parts which could cause problems.

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How to get support for Linux on your PC

While Linux runs on personal computer hardware, administration of a Linux system is not a negligible task. Like any other computer at Fermilab, if you want operating system maintenance, you must arrange for it. The Computing Division maintains many systems on site under agreements (MOUs) with the various Divisions and Sections. Some are maintained by local system administrators and others by the individual users. All of these support models work well for different situations and all can be overloaded by rapid, unanticipated growth. Please contact your local computing coordinator to request support for your Linux PC.

For hardware maintenance of Linux boxes, one should count on using support channels similar to the ones currently in use for traditional Unix workstations. For persons whose desktop support is provided through an MOU with the Computing Division, support for Linux workstations is provided on the same basis as other Unix workstations. Hardware support is available through Decision One on both a contract ("insurance policy" type) and per event, (time and materials) basis. The Computing Division does not provide swap-out service for any equipment (except supported SCSI peripherals as denoted within an MOU).

The Linux installation guide and install server is available to those who wish to maintain their own systems. To the degree that these "user maintained" systems are configured in accordance with the FNAL standard distribution, advisory help will be available on a best effort basis through `helpdesk@fnal.gov`. Similarly, people are free to do their own hardware installations and maintenance if they so choose (though this may void an "insurance policy" contract).

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NT and Linux

NT and Linux on the Fermilab Desktop.

Many physicists will purchase PCs to run NT, NT/Linux (dual boot) and Linux alone as desktop workstations. All three possibilities will be supported by the Computing Division.

NT

The DCD/PCS group provides NT support to the Fermilab community. Most computer integrators (Compaq, Dell, Micron or Gateway) will sell a workstation with NT already installed. If you are only going to use NT on the system, we recommend this path. With minor configuration tuning (NT domain and network) the system can be operational soon after delivery. The PC Support and Data Communications groups of the Distributed Computing Department can assist with the configuration. For more information regarding NT at Fermilab or specific support questions send email to dcd-pcs@fnal.gov.

Linux

The Field Systems Support Group in the Operating Systems Support Department of the Computing Division will provide Linux support for the Fermilab community. Please make sure the system you are purchasing supports running Linux (see earlier article “How To Order a PC to Run Linux”). For more information regarding Linux at Fermilab refer to the information available at:

`http://www.fnal.gov/cd/unix/linux/`

or send specific questions to `helpdesk@fnal.gov`.

NT/Linux

The Computing Division recognizes that in certain environments, running more than one operating system may be required. Setting up a PC to run more multiple operating systems requires additional effort before the system is put into production. (Make sure when ordering your PC that the hardware you purchase is compatible with both operating systems (see earlier article “How To Order a PC to Run Linux”)).

NT and Linux will need to be in separate disk partitions because they support different native file systems. When setting up your disk partitions, remember to keep it simple, but a minimum of 3 partitions are required: one for NT and 2 for Linux. There are several methods of selecting between the operating systems at boot time. Both NT’s bootloader (NTLDR) and Linux’s (LILO) are capable of doing this job. Instructions on how to configure a boot loader can be found at `http://www.fnal.gov/cd/unix/linux/`

It should be pointed out that these dual-boot systems should not provide any network-based services that one could not live without. In other words, these machines should not serve disks to any other machine or support network logins, since they are by design subject to reboot at any time.

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